

This listing of claims will replace all prior versions,
and listings, of claims in the application:

1 Claim 1 (cancelled)

1 Claim 2 (currently amended): Apparatus for use in a base
2 station in an orthogonal frequency division multiplexing
3 (OFDM) based spread spectrum multiple access wireless
4 system comprising:

5 a sequence generator for generating one or more pilot
6 tone hopping sequences each including pilot tones, said
7 pilot tones each being generated at frequency and time
8 instants in a time-frequency grid;

9 a waveform generator, responsive to said one or more
10 pilot tone hopping sequences, for generating a waveform for
11 transmission; and

12 ~~The invention as defined in claim 1~~

13 wherein each of said one or more pilot tone hopping
14 sequences is a Latin Squares based pilot tone hopping
15 sequence.

1 Claim 3-6 (cancelled)

1 Claim 7 (currently amended): Apparatus for use in a base
2 station in an orthogonal frequency division multiplexing
3 (OFDM) based spread spectrum multiple access wireless
4 system comprising:

5 a sequence generator for generating one or more pilot
6 tone hopping sequences each including pilot tones, said

7 pilot tones each being generated at frequency and time
 8 instants in a time-frequency grid;
 9 a waveform generator, responsive to said one or more
 10 pilot tone hopping sequences, for generating a waveform for
 11 transmission;
 12 wherein said sequence generator generates each of
 13 said one or more pilot tone hopping sequences in accordance
 14 with $S_i = \{f_0^{s_i}, f_1^{s_i}, \dots, f_k^{s_i}, \dots\}$, for $i = 1, \dots, N_{pil}$; and ~~The invention as~~
 15 defined in claim 3
 16 wherein $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a
 17 time instant index, "T", "a", "s_i" and "d" are integer
 18 constants, "p" is a prime constant, and "Z" is a
 19 permutation operator.

1 Claim 8 (original): The invention as defined in claim 7
 2 wherein said prescribed number of symbol intervals T is a
 3 prime number.

1 Claim 9 (original): The invention as defined in claim 7
 2 wherein each of said one or more pilot tone hopping
 3 sequences generated includes a prime number of distinct
 4 tones.

1 Claim 10 (currently amended): The invention as defined in
 2 claim 7 wherein said permutation operator Z is defined on
 3 $[\text{MIN}(0, d), \text{MAX}(N, -1, p-1+d)]$ and "N," is the total
 4 number of tones in the system, p is a prime number of tones
 5 and "d" is a ~~prescribed~~ frequency.

1 Claim 11 (currently amended): The invention as defined in
 2 claim 7 wherein each of said one or more pilot tone hopping
 3 sequences has a ~~prescribed~~ slope "a".

1 Claim 12 (original): The invention as defined in claim 11
 2 wherein said slope "a" is unique to said base station among
 3 one or more neighboring base stations.

1 Claim 13 (currently amended): Apparatus for use in a base
 2 station in an orthogonal frequency division multiplexing
 3 (OFDM) based spread spectrum multiple access wireless
 4 system comprising:

5 a sequence generator for generating one or more pilot
 6 tone hopping sequences each including pilot tones, said
 7 pilot tones each being generated at frequency and time
 8 instants in a time-frequency grid;

9 a waveform generator, responsive to said one or more
 10 pilot tone hopping sequences, for generating a waveform for
 11 transmission; and

12 ~~The invention as defined in claim 1~~

13 wherein said waveform generator generates a waveform

14 in accordance with $\sum_{i=1}^{N_{pil}} C_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the

15 sequence $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, Δf is the basic

16 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known

17 symbol to be transmitted at the k^{th} symbol instant and tone

18 $f_k^{S_i}$.

1 Claim 14 (original): The invention as defined in claim 13

2 wherein $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time

3 instant index, "T", "a", "s_i" and "d" are integer constants,
4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 15 (currently amended): Apparatus for use in a base
2 station in an orthogonal frequency division multiplexing
3 (OFDM) based spread spectrum multiple access wireless
4 system comprising:

5 a sequence generator for generating one or more pilot
6 tone hopping sequences each including pilot tones, said
7 pilot tones each being generated at frequency and time
8 instants in a time-frequency grid; and

9 a waveform generator, responsive to said one or more
10 pilot tone hopping sequences, for generating a waveform for
11 transmission. ~~The invention as defined in claim 1~~

12 wherein said waveform generator generates a waveform

13 in accordance with $\sum_{i=1}^{N_{pil}} C_k^{S_i} \Gamma_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the
14 sequence $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, Δf is the basic
15 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known
16 symbol to be transmitted at the k^{th} symbol instant and tone
17 $f_k^{S_i}$, and $\Gamma_k^{S_i} = 1$, if $f_k^{S_i} \in [0, N_f - 1]$, and $\Gamma_k^{S_i} = 0$, otherwise.

1 Claim 16 (original): The invention as defined in claim 15
2 wherein $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
3 instant index, "T", "a", "s_i" and "d" are integer constants,
4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 17 (original): The invention as defined in claim 16
2 wherein said waveform generator includes a transmitter for
3 transmitting said pilot tones and wherein pilot tones in

4 phantom tone regions defined by $[\text{MIN}(0, d), 0]$ and $[N, -1,$
 5 $\text{MAX}(N, -1, p-1+d)]$, where " N ," is the total number of tones
 6 in the system, p is a prime number of tones and " d " is a
 7 prescribed frequency, are not transmitted.

1 Claim 18 (cancelled)

1 Claim 19 (currently amended): A method for use in a base
 2 station in an orthogonal frequency division multiplexing
 3 (OFDM) based spread spectrum multiple access wireless
 4 system comprising the steps of:

5 generating one or more pilot tone hopping sequences
 6 each including pilot tones, said pilot tones each being
 7 generated at frequency and time instants in a
 8 time-frequency grid; and

9 in response to said one or more pilot tone hopping
 10 sequences, generating a waveform for transmission, The
 11 method as defined in claim 18

12 wherein each of said one or more pilot tone hopping
 13 sequences is a Latin Squares based pilot tone hopping
 14 sequence.

1 Claim 20 - 23 (canceled)

1 Claim 24 (currently amended): A method for use in a base
 2 station in an orthogonal frequency division multiplexing
 3 (OFDM) based spread spectrum multiple access wireless
 4 system comprising the steps of:

5 generating one or more pilot tone hopping sequences
 6 each including pilot tones, said pilot tones each being

7 generated at frequency and time instants in a
 8 time-frequency grid;
 9 in response to said one or more pilot tone hopping
 10 sequences, generating a waveform for transmission; and
 11 wherein said step of generating one or more pilot tone
 12 hopping sequences includes a step of generating each of
 13 said one or more pilot tone hopping sequences in accordance
 14 with $S_i = \{f_0^{s_i}, f_1^{s_i}, \dots, f_k^{s_i}, \dots\}$, for $i=1, \dots, N_{pil}$, and The method as
 15 defined in claim 20
 16 wherein $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 17 instant index, "T", "a", "s_i" and "d" are integer constants,
 18 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 25 (original): The method as defined in claim 24
 2 wherein said prescribed number of symbol intervals T is a
 3 prime number.

1 Claim 26 (original): The method as defined in claim 24
 2 wherein said step of generating one or more pilot tone
 3 hopping sequences includes a step of generating each of
 4 said one or more pilot tone hopping sequences having a
 5 prime number of distinct tones.

1 Claim 27 (currently amended): The method as defined in
 2 claim 24 wherein said permutation operator Z is defined on
 3 $[\text{MIN}(0, d), \text{MAX}(N_t - 1, p - 1 + d)]$ and " N_t " is the total
 4 number of tones in the system, p is a prime number of tones
 5 and "d" is a ~~prescribed~~ frequency.

1 Claim 28 (currently amended): The method as defined in
 2 claim 24 wherein said step of generating one or more pilot
 3 tone hopping sequences includes a step of generating each
 4 of said one or more pilot tone hopping sequences having a
 5 ~~prescribed~~ slope "a".

1 Claim 29 (original): The method as defined in claim 28
 2 wherein said slope "a" is unique to said base station among
 3 one or more neighboring base stations.

AB
Cont.
 1 Claim 30 (currently amended): A method for use in a base
 2 station in an orthogonal frequency division multiplexing
 3 (OFDM) based spread spectrum multiple access wireless
 4 system comprising the steps of:

5 generating one or more pilot tone hopping sequences
 6 each including pilot tones, said pilot tones each being
 7 generated at frequency and time instants in a
 8 time-frequency grid;

9 in response to said one or more pilot tone hopping
 10 sequences, generating a waveform for transmission; and The
 11 ~~method as defined in claim 18~~

12 wherein said step of generating said waveform includes
 13 a step of generating said waveform in accordance with

14 $\sum_{i=1}^{N_{pil}} C_k^{S_i} e^{2\pi f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the sequence

15 $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, where Δf is the basic
 16 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known
 17 symbol to be transmitted at the k^{th} symbol instant and tone
 18 $f_k^{S_i}$.

1 Claim 31 (original): The method as defined in claim 30
 2 wherein $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 3 instant index, "T", "a", "s_i" and "d" are integer constants,
 4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 32 (currently amended): A method for use in a base
 2 station in an orthogonal frequency division multiplexing
 3 (OFDM) based spread spectrum multiple access wireless
 4 system comprising the steps of:

5 generating one or more pilot tone hopping sequences
 6 each including pilot tones, said pilot tones each being
 7 generated at frequency and time instants in a
 8 time-frequency grid;

9 in response to said one or more pilot tone hopping
 10 sequences, generating a waveform for transmission; and ~~The~~
 11 ~~method as defined in claim 18~~

12 wherein said step of generating said waveform includes
 13 a step of generating said waveform in accordance with

14 $\sum_{i=1}^{N_{pil}} C_k^{s_i} \Gamma_k^{s_i} e^{2\pi j f_k^{s_i} \Delta t}$, where $f_k^{s_i}$ are given by the sequence

15 $S_i = \{f_0^{s_i}, f_1^{s_i}, \dots, f_k^{s_i}, \dots\}$, for $i=1, \dots, N_{pil}$, where Δf is the basic
 16 frequency spacing between adjacent tones, $C_k^{s_i}$ is a known
 17 symbol to be transmitted at the k^{th} symbol instant and tone
 18 $f_k^{s_i}$, and $\Gamma_k^{s_i} = 1$, if $f_k^{s_i} \in [0, N_f - 1]$, and $\Gamma_k^{s_i} = 0$, otherwise.

1 Claim 33 (original): The method as defined in claim 32
 2 wherein $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 3 instant index, "T", "a", "s_i" and "d" are integer constants,
 4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 34 (original): The method as defined in claim 33
2 further including a step of transmitting said pilot tones
3 and wherein pilot tones in phantom tone regions defined by
4 $[\text{MIN}(0, d), 0]$ and $[N_i - 1, \text{MAX}(N_i - 1, p - 1 + d)]$, where " N_i ,"
5 is the total number of tones in the system, p is a prime
6 number of tones and " d " is a prescribed frequency are not
7 transmitted.

1 Claim 35 (cancelled)

13
1 Claim 36 (currently amended): Apparatus for use in a base
2 station in an orthogonal frequency division multiplexing
3 (OFDM) based spread spectrum multiple access wireless
4 system comprising:

5 means for generating one or more pilot tone hopping
6 sequences each including pilot tones, said pilot tones each
7 being generated at frequency and time instants in a
8 time-frequency grid;

9 means, responsive to said one or more pilot tone
10 hopping sequences, for generating a waveform for
11 transmission; and ~~The invention as defined in claim 35~~

12 wherein each of said one or more pilot tone hopping
13 sequences is a Latin Squares based pilot tone hopping
14 sequence.

1 Claim 37 -40 (canceled)

1 Claim 41 (currently amended): Apparatus for use in a base
2 station in an orthogonal frequency division multiplexing
3 (OFDM) based spread spectrum multiple access wireless
4 system comprising:

5 means for generating one or more pilot tone hopping
 6 sequences each including pilot tones, said pilot tones each
 7 being generated at frequency and time instants in a
 8 time-frequency grid; and

9 means, responsive to said one or more pilot tone
 10 hopping sequences, for generating a waveform for
 11 transmission,

12 wherein said step of generating one or more pilot tone
 13 hopping sequences includes a step of generating each of
 14 said one or more pilot tone hopping sequences in accordance
 15 with $S_i = \{f_0^{s_i}, f_1^{s_i}, \dots, f_k^{s_i}, \dots\}$, for $i=1, \dots, N_{pt}$, and

16 ~~The invention as defined in claim 37 wherein~~

17 $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time instant
 18 index, "T", "a", "s_i" and "d" are integer constants, "p" is
 19 a prime constant, and "Z" is a permutation operator.

1 Claim 42 (original): The invention as defined in claim 41
 2 wherein said prescribed number of symbol intervals T is a
 3 prime number.

1 Claim 43 (original): The invention as defined in claim 41
 2 wherein said means for generating one or more pilot tone
 3 hopping sequences includes means for generating each of
 4 said one or more pilot tone hopping sequences having a
 5 prime number of distinct tones.

1 Claim 44 (original): The invention as defined in claim 41
 2 wherein said permutation operator Z is defined on $[\text{MIN}(0,$
 3 $d), \text{MAX}(N_t - 1, p - 1 + d)]$ and "N_t" is the total number of

4 tones in the system, p is a prime number of tones and " d "
5 is a prescribed frequency.

1 Claim 45 (currently amended): The invention as defined in
2 claim 41 wherein said means for generating one or more
3 pilot tone hopping sequences includes means for generating
4 each of said one or more pilot tone hopping sequences
5 having a ~~prescribed~~ slope " a ".

1 Claim 46 (original): The invention as defined in claim 45
2 wherein said slope " a " is unique to said base station among
3 one or more neighboring base stations.

1 Claim 47 (currently amended): Apparatus for use in a base
2 station in an orthogonal frequency division multiplexing
3 (OFDM) based spread spectrum multiple access wireless
4 system comprising:

5 means for generating one or more pilot tone hopping
6 sequences each including pilot tones, said pilot tones each
7 being generated at frequency and time instants in a
8 time-frequency grid;

9 means, responsive to said one or more pilot tone
10 hopping sequences, for generating a waveform for
11 transmission; and

1 ~~The invention as defined in claim 35~~

2 wherein said means for generating said waveform
3 includes means for generating said waveform in accordance

4 with $\sum_{i=1}^{N_{pil}} C_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the sequence

5 $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, where Δf is the basic

6 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known
 7 symbol to be transmitted at the k^{th} symbol instant and tone
 8 $f_k^{S_i}$.

1 Claim 48 (original): The invention as defined in claim 47
 2 wherein $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 3 instant index, "T", "a", " s_i " and "d" are integer constants,
 4 "p" is a prime constant, and "Z" is a permutation operator.

13 *AB Cont.*
 1 Claim 49 (currently amended): Apparatus for use in a base
 2 station in an orthogonal frequency division multiplexing
 3 (OFDM) based spread spectrum multiple access wireless
 4 system comprising:

5 means for generating one or more pilot tone hopping
 6 sequences each including pilot tones, said pilot tones each
 7 being generated at frequency and time instants in a time-
 8 frequency grid;

9 means, responsive to said one or more pilot tone
 10 hopping sequences, for generating a waveform for
 11 transmission; and

12 ~~The invention as defined in claim 35~~

13 wherein said means for generating said waveform
 14 includes means for generating said waveform in accordance

15 with $\sum_{i=1}^{N_{pil}} C_k^{S_i} \Gamma_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the sequence

16 $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, where Δf is the basic

17 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known

18 symbol to be transmitted at the k^{th} symbol instant and tone

19 $f_k^{S_i}$, and $\Gamma_k^{S_i} = 1$, if $f_k^{S_i} \in [0, N_t - 1]$, and $\Gamma_k^{S_i} = 0$, otherwise.

1 Claim 50 (original): The invention as defined in claim 49
2 wherein $f_k^s = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
3 instant index, "T", "a", " s_i " and "d" are integer constants,
4 "p" is a prime constant, and "Z" is a permutation operator.

Art.
1 Claim 51 (original): The invention as defined in claim 50
2 further including means for transmitting said pilot tones
3 and wherein pilot tones in phantom tone regions defined by
4 $[\text{MIN}(0, d), 0]$ and $[N_t - 1, \text{MAX}(N_t - 1, p - 1 + d)]$, where " N_t ,"
5 is the total number of tones in the system, p is a prime
6 number of tones and "d" is a prescribed frequency are not
7 transmitted.
